ETHYL CORPORATION

CORPORATE ENVIRONMENTAL AFFAIRS

November 14, 1986

PLEASE ADDRESS REPLY
TO: 451 FLORIDA BLVD
BATON ROUGE, LA. 70801

Ms. Virginia Loselle
Michigan Department of Natural Resources
Groundwater Quality Division
15500 Sheldon Road
Northville, MI 48167

Dear Ms. Loselle:

The environmental investigation of Ethyl's Ferndale Laboratory, as outlined in your letter of August 18, 1986, has been completed, and all requested data are enclosed.

As you observed on October 1, all of the high and erratic magnetometer readings in the nine-acre field across the north end of the property and the small open area just south of it were checked by digging with a backhoe. All of the ten holes were clean with no sign of chemical containers or contamination. Digging was more difficult than expected because most of the holes in the north plot uncovered foreign fill, clay, pieces of unreinforced concrete, and bricks, which had been used to level the field about 1953.

The absence of contamination was as expected because we had no information that anything had ever been buried in this area. The erratic magnetometer readings resulted from some electrical disturbance, either natural or from the nearby power lines.

Seven soils gas samples were taken in the three gasoline storage tank farm areas to determine if there was any contamination from prior tank leakage. An eighth sample was taken upgradient for use as a background sample. These were analyzed by gas chromatography by Burmah Technical Services whose report is attached. No contamination was found in any of them. This is consistent with the report by the Ferndale Fire Marshall, who monitored the removal of the tanks in 1985 and did not see any sign of contamination in any of the holes.

Four additional monitoring wells were drilled by Testing Engineers & Consultants, Inc. on October 8 and 9. The wells are all screwed four-inch PVC pipe construction with wrapped PVC screen as specified. The enclosed report includes the drilling logs and the results of the sieve analyses of the sand samples taken during the drilling of each well. These analyses describe a very uniform, fine sand. Average particle size was derived from the screen data and used in the definitive calculation of water flow through the sand versus slope of the water level. These calculations are attached.

The new wells and four of the old wells were sampled on October 10 and analyzed by Burmah Technical Services. All three of the new wells in the area north of the parking lot showed traces of organics which are evidently the result of disposals many years ago. The average concentration was 0.04 parts per million. This area measures 200 feet from west to east by 110 feet from north to south, and the water depth was 9.2 feet on October 10. The water levels in the three wells indicated the flow was directly east with a slope of 1.0 feet per 100 feet. By the attached calculation, the water flow was 0.678 gal./(day)(sq.ft.). At this flow and concentration, the mass flow of organics leaving the area is only 0.083 pounds per year, or about one fluid ounce annually. The total amount of organics in the water under the area is about two fluid ounces.

The relatively high water slope makes us suspect that there is an interception point nearby. There are two parallel sewer lines between Ethyl's east fence and Pinecrest Avenue and the elevations permit infiltration into either of them. The newer one, which flows into the Twelve Town System, was designed to drain both sides of Pinecrest.

Some of the water is obviously being intercepted by the sewer system on the property. Even during dry weather, there is a constant flow in the sewers coming from both the north and west.

As we reported previously, Peter Shirey of the Geological Survey Division of the Michigan DNR searched their files and concluded that there were neither any wells nor aquifers near our property.

Well #8 was planned as an upgradient well, but the organics found here, only ten feet from the west fence line, may indicate that some of the contamination in the area could be from the area beyond AE Building. The flow directions and the water levels are consistent with this possibility.

In any case, there is very little organic material present in the water or leaving the property.

The highest concentration of organics was found in Well #7, the new well northeast of AE Building. This well contained less than 0.7 parts per million of chlorinated organics. The other wells in this area were clean except for traces of tetrahydrofuran, the pipe glue found previously.

The flow direction measured in this area has swung about twenty degrees more easterly since we measured it in April, 1986, when the water level was two feet higher. From the measured slope of 0.42 feet per 100 feet, we calculate the flow to be 0.285 gal/(day)(sq.ft.).

The analysis from Well #7 is still indicative of a small amount of chemical. If we assume this analysis is typical of a 30-degree plume from the farthest pits, a plume 100 feet wide and 14 feet deep, the flow of hydrocarbons is only 0.8 pounds per year. We suspect that the plume is much smaller than this worst case scenario because the soil gas sample taken 125 feet downgradient from Well #7 was completely clean. This soil gas sample was a background check for the gasoline tank farm behind R Building, and it would have spotted any significant contamination in the water beneath it. The volatile and slightly soluble hydrocarbons evaporate preferentially from unconfined groundwater, but we would expect some remnant of the plume at this point unless it is many times smaller than assumed.

The data to date show that there are no removable containers or treatable concentrations of chemicals on the property. There appears to be a plume of minor contamination from known disposal points which were thoroughly dug into when the Laboratory was closed to be certain that there would be no future releases. The amount of contaminant under the property is quite small. If the four analyses represent a 30-degree plume stretching from the farthest disposal point all the way to the sewers beyond the east fence, we calculate only about twelve pounds of chemical is present .

As shown in the earlier calculations, the concentrations and amounts leaving the property are far too low to threaten either health or the environment, especially in the absence of any water wells in the area.

Very truly yours

C. E. Colvin

CEC:imc
Attachments

cc: S. Cunningham
D. C. Bach
D. E. Park

Water Flow Calculations

The rate of water flow through the fine sand under the Laboratory Property was calculated using the "Leva" correlation as described on pages 5-50 and 5-51 in the fourth edition of Perry's Chemical Engineers' Handbook.

This required successive calculations of the average sand particle diameter Dp, the modified Reynolds number N_{Re}', the friction factor f_m, and finally the pressure drop or water slope.

For sand of mixed sizes, the average particle diameter can be calculated as

$$\frac{1}{Dp} = \Sigma \frac{X}{Dp,x}$$

where x = weight fractions of particle diameter Dp,x.

The four sieve analyses by Testing Engineers & Consultants, Inc. were averaged to give the following distribution of particle sizes:

	wt. fraction, x	Dpx
larger than #4 screen	.00125	6.73 mm
between #4 and #8	.00300	3.37 mm
between #8 and #16	.00675	1.68 mm
between #16 and #30	.02975	.841 mm
between #30 and #50	.12450	.420 mm
between #50 and #100	.43200	.209 mm
between #100 and #200	.33575	.105 mm
smaller than #200 screen	.06700	.052 mm

From these data we calculated Dp = 0.145 mm or 0.000476 ft.

The modified Reynolds number is defined as:

$$N_{Re}' = \frac{DpG}{\mu}$$

where G = water flow rate based on an empty chamber in lb./(hr.)(sq.ft.) and μ = water viscosity in lb./(ft.)(hr.).

Using the viscosity of water at 68^{o}F 2.42 lb/(ft.)(hr.) and the arbitrary value for G of .508 lb./(hr.)(sq.ft.), we calculate $N_{Re}' = 10^{-4}$ (dimensionless).

The friction factor fm = 10^6(dimensionless) at this Reynolds number from Figure 5-64 in the text.

The pressure drop across the sand at this flow was then calculated with the Leva correlation,

$$\Delta P = \frac{2fmG^2L(1-\varepsilon)^{3-n}}{Dpgc\rho\phi^{3-n}\varepsilon^3}$$

where
- ΔP = pressure drop in lbs./sq.ft.
- L = length of flow path, taken at 100 ft.
- ε = void fraction in the sand, 0.3
- n = exponent = 1 at $N_{Re}' < 10$
- gc = dimensional constant, 32.17 $ft./sec.^2$
- ρ = fluid density, 62.4 $lb./ft.^3$
- ϕ = shape factor, average for sand .75

$\Delta P_{100\ ft.} = 134.5\ lb./ft.^2$

This $\Delta P_{100\ ft.}$ may be converted to a slope by dividing by the density of water 62.4 $lb/ft.^3$.

slope = 2.16 ft./100 ft.

This involved calculation at a single flow rate, G = .508 lb./(hr.)(sq.ft.) or the more familiar Q = 1.464 gal./(day) (sq.ft.), does not have to be repeated for other flow rates because flow is directly proportional to ΔP or slope in this laminar flow region and the generalized correlation below can be used

G(lb)/(hr)(sq.ft.) = .235 slope (ft.)/(100 ft.)
Q (gal)/(day)(sq.ft.) = .678 slope (ft.)/(100 ft.)

From the well water levels taken on October 10, 1986, we calculate the following slopes and flows:

Region	Slope ft./100 ft.	Q.(gal)/ (day)(sq.ft.)	Rate, ft./year
NW of AE Bldg.	.42	.285	46
N of Parking Lot	1.0	.678	110